

Claims

What is claimed is:

- 1 1. An instrument for measuring particles of combustion exhausts
2 comprising:
 - 3 a laser for producing a high intensity laser pulse;
 - 4 a sample cell for receiving combustion exhaust input and said high
5 intensity laser pulse; and
 - 6 at least one detector for detecting a signal generated by particles in
7 said received combustion exhaust input, said signal including laser induced
8 incandescence (LII).
- 1 2. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 further includes a plurality of optical elements coupling
3 said high intensity laser pulse to said sample cell.
- 1 3. An instrument for measuring particles of combustion exhausts
2 as recited in claim 2 wherein said plurality of optical elements include a
3 plurality of cylindrical lenses.
- 1 4. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 further includes a plurality of focusing elements coupling
3 said signal generated by particles in said received combustion exhaust input
4 in said sample cell to said at least one detector.
- 1 5. An instrument for measuring particles of combustion exhausts
2 as recited in claim 4 wherein said plurality of focusing elements include a
3 plurality of spherical lenses.
- 1 6. An instrument for measuring particles of combustion exhausts
2 as recited in claim 4 further includes a filter for filtering said signal generated
3 by particles in said received combustion exhaust input.
- 1 7. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 further includes signal conditioning electronics coupled
3 to said at least one detector.

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1 8. An instrument for measuring particles of combustion exhausts
2 as recited in claim 7 wherein said signal conditioning electronics includes a
3 peak detector.

1 9. An instrument for measuring particles of combustion exhausts
2 as recited in claim 7 wherein said signal conditioning electronics includes a
3 calibration multiplier.

1 10. An instrument for measuring particles of combustion exhausts
2 as recited in claim 7 wherein said signal conditioning electronics includes a
3 display for displaying particle measurements.

1 11. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 includes a display coupled to said at least one detector
3 for displaying data related to mass concentration, number density, and
4 particle size of particles in said received combustion exhaust input.

1 12. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 wherein said at least one detector for detecting a signal
3 generated by particles in said received combustion exhaust input detects
4 said signal during transient operation of an engine.

1 13. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 wherein said at least one detector for detecting a signal
3 generated by particles in said received combustion exhaust input includes at
4 least one photo-multiplier tube (PMT) detector.

1 14. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 wherein said at least one detector for detecting a signal
3 generated by particles in said received combustion exhaust input includes a
4 pair of photo-multiplier tube (PMT) detectors.

1 15. An instrument for measuring particles of combustion exhausts
2 as recited in claim 14 includes signal conditioning electronics coupled to
3 each of said pair of photo-multiplier tube (PMT) detectors.

1 16. An instrument for measuring particles of combustion exhausts
2 as recited in claim 1 includes a dilution tunnel coupling said combustion
3 exhaust input to said sample cell.

1 17. A method for measuring particles of combustion exhausts
2 comprising the steps of:
3 utilizing a laser, producing a high intensity laser pulse;
4 receiving a combustion exhaust input and said high intensity laser
5 pulse in a sample cell; and
6 detecting a signal generated by particles in said received combustion
7 exhaust input, said signal including laser induced incandescence (LII).

1 18. A method for measuring particles of combustion exhausts as
2 recited in claim 17 further includes the steps of conditioning said detected
3 signal and displaying data related to the particles in said received
4 combustion exhaust input.

1 19. A method for measuring particles of combustion exhausts as
2 recited in claim 18 wherein the step of displaying data related to the particles
3 in said received combustion exhaust input includes the steps of displaying
4 data related to mass concentration, number density, and particle size of
5 particles in said received combustion exhaust input.

1 20. A method for measuring particles of combustion exhausts as
2 recited in claim 17 wherein the step of detecting a signal generated by
3 particles in said received combustion exhaust input includes the detecting a
4 signal generated by particles in said received combustion exhaust input
5 during transient operation of an engine.